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(54) REMOTE MIRRORING METHOD BETWEEN TIERED STORAGE SYSTEMS

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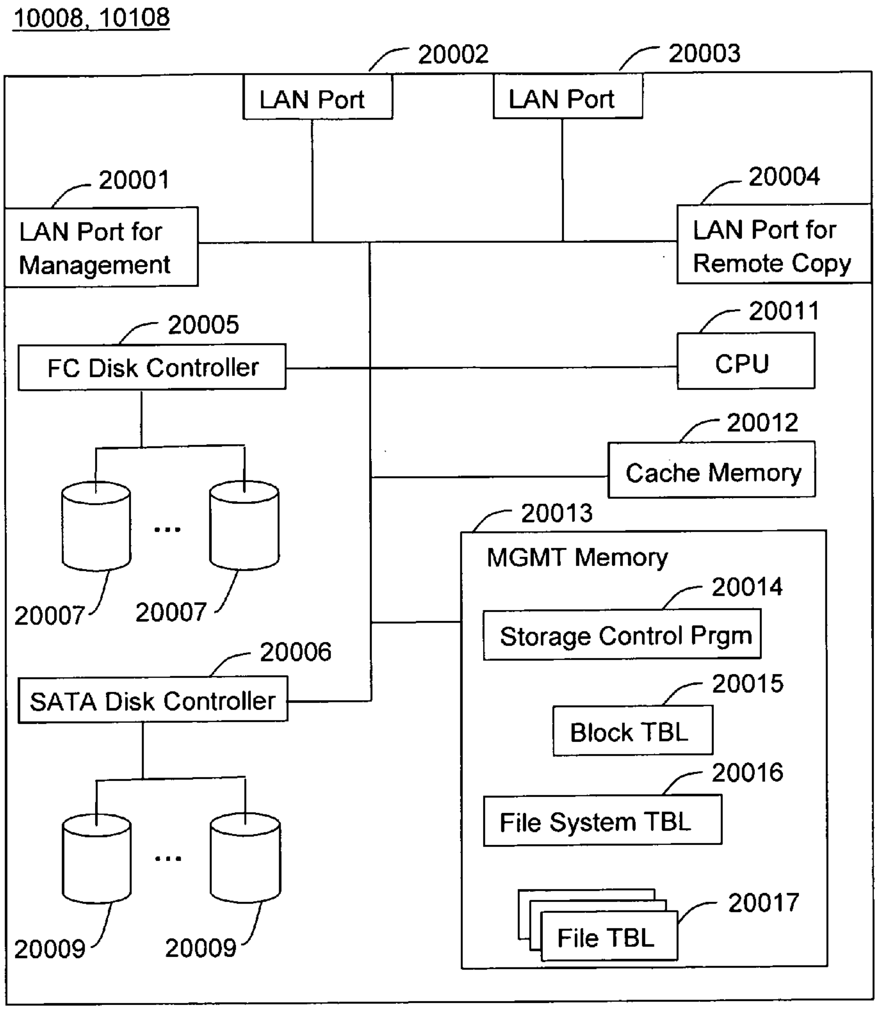
(57) ABSTRACT

A method and system are provided in which files copied from a local storage system to a remote storage system are copied in such a manner that they reflect the arrangement and hierarchy of those files in the local storage system, including storage class. This allows the remote storage system to provide the desired properties and performance for the files in the same manner as the local storage system. Further, in the case where a file in the local storage system is migrated from one storage class to another storage class, the local storage system sends a migration command to the remote storage system. The migration command includes the target storage class to which the corresponding file in the remote storage system is to be migrated.



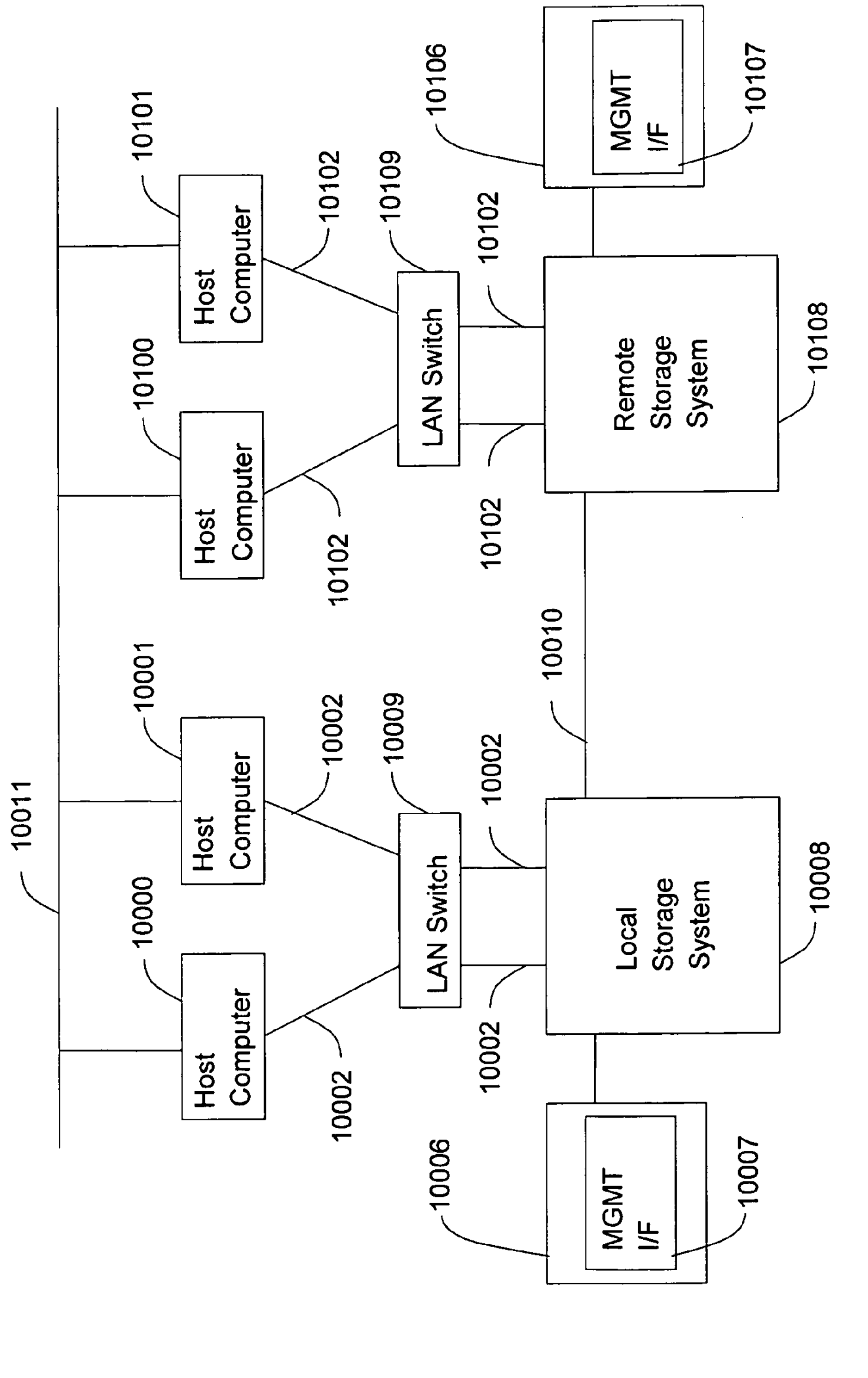

10011
10000
Host Computer
10001
Host Computer
10100
Host Computer
10101
Host Computer
10002
10002
10009
LAN Switch
10002
10002
10102
10102
10109
LAN Switch
10102
10102
10010
Local Storage System
10008
Remote Storage System
10108
10006
MGMT I/F
10007
10106
MGMT I/F
10107

FIG. 1

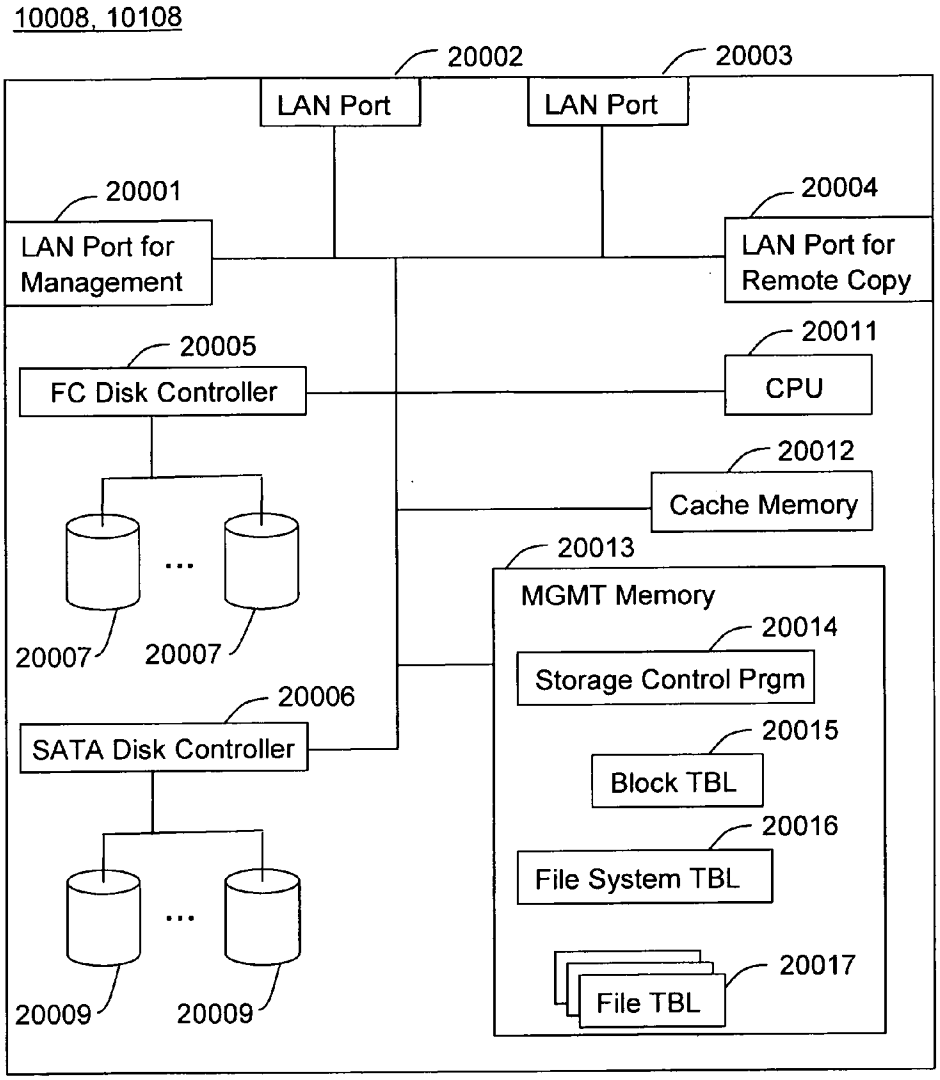
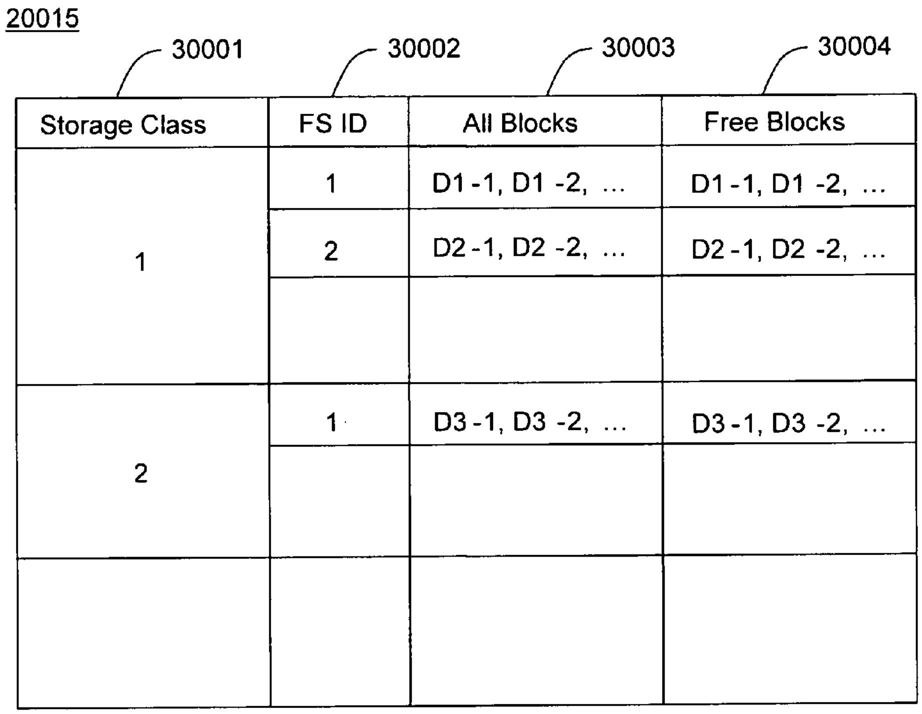
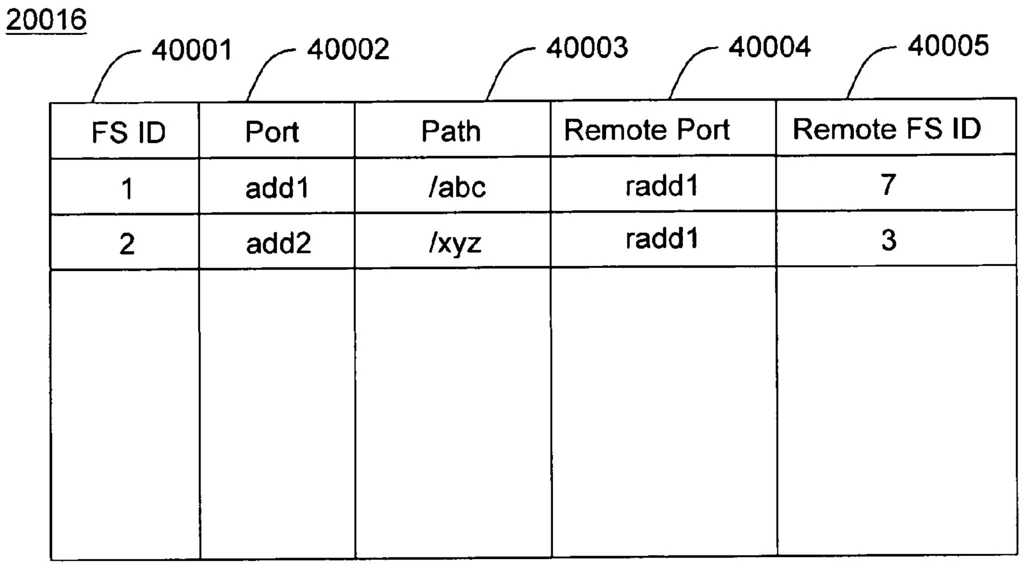

10008, 10108
20002
20003
LAN Port
LAN Port
20001
20004
LAN Port for Management
LAN Port for Remote Copy
20005
20011
FC Disk Controller
CPU
20012
Cache Memory
...
20013
MGMT Memory
20007
20007
20014
Storage Control Prgm
20006
SATA Disk Controller
20015
Block TBL
20016
File System TBL
...
20017
File TBL
20009
20009

FIG. 2


20015
30001
30002
30003
30004

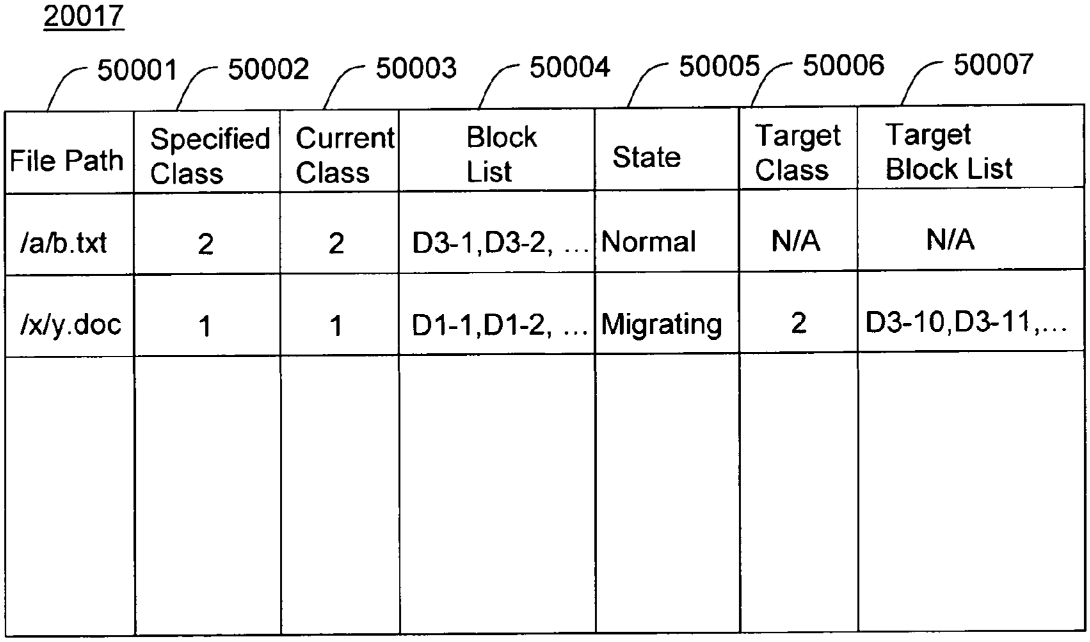
Storage Class	FS ID	All Blocks	Free Blocks
1	1	D1 -1, D1 -2, ...	D1 -1, D1 -2, ...
	2	D2 -1, D2 -2, ...	D2 -1, D2 -2, ...
2	1	D3 -1, D3 -2, ...	D3 -1, D3 -2, ...

FIG. 3


20016
40001
40002
40003
40004
40005

FS ID	Port	Path	Remote Port	Remote FS ID
1	add1	/abc	radd1	7
2	add2	/xyz	radd1	3

FIG. 4


20017
50001
50002
50003
50004
50005
50006
50007

File Path	Specified Class	Current Class	Block List	State	Target Class	Target Block List
/a/b.txt	2	2	D3-1,D3-2, ...	Normal	N/A	N/A
/x/y.doc	1	1	D1-1,D1-2, ...	Migrating	2	D3-10,D3-11,...

FIG. 5

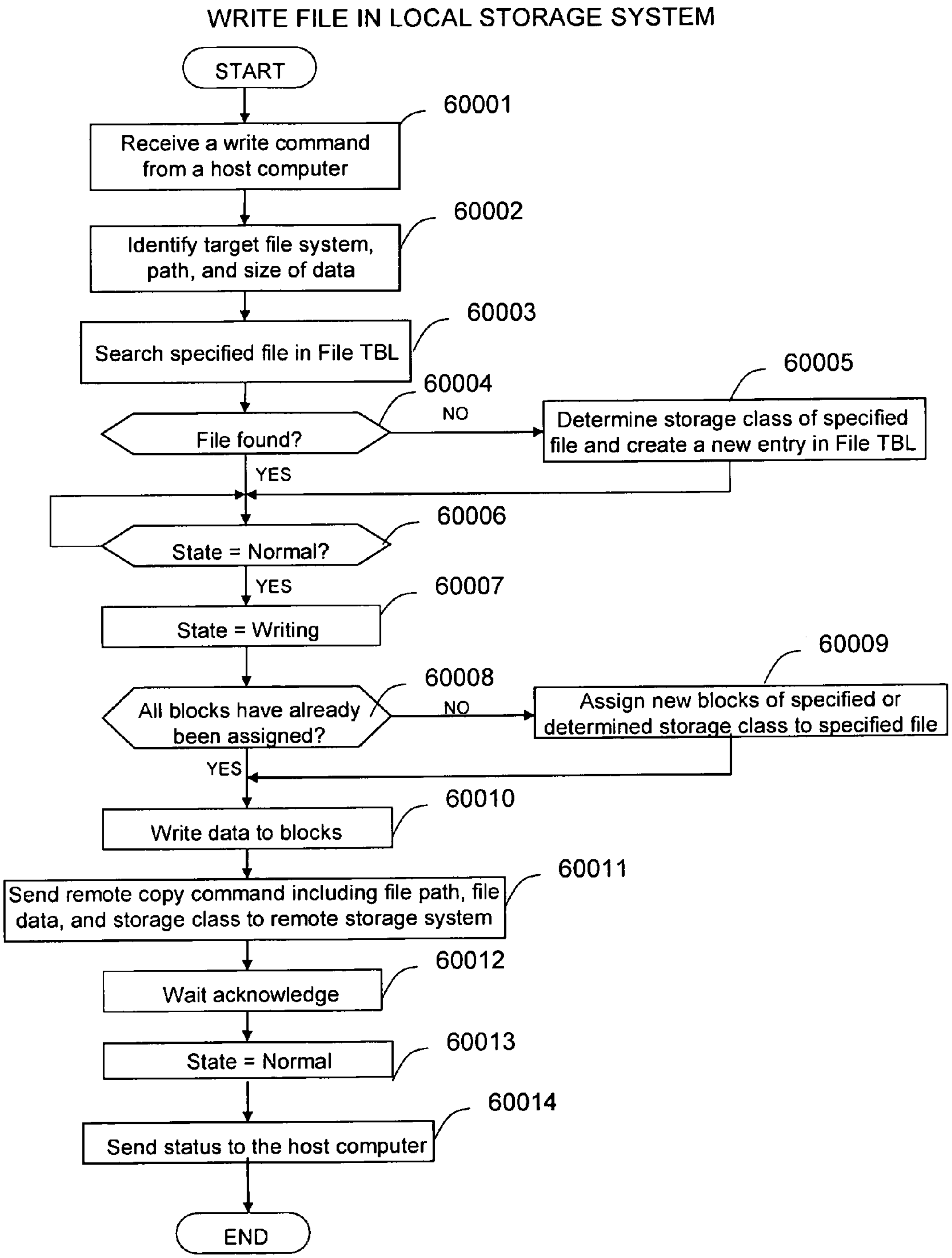

WRITE FILE IN LOCAL STORAGE SYSTEM
START
60001
Receive a write command from a host computer
60002
Identify target file system, path, and size of data
60003
Search specified file in File TBL
60004
File found?
NO
60005
Determine storage class of specified file and create a new entry in File TBL
YES
60006
State = Normal?
YES
60007
State = Writing
60008
All blocks have already been assigned?
NO
60009
Assign new blocks of specified or determined storage class to specified file
YES
60010
Write data to blocks
60011
Send remote copy command including file path, file data, and storage class to remote storage system
60012
Wait acknowledge
60013
State = Normal
60014
Send status to the host computer
END

FIG. 6

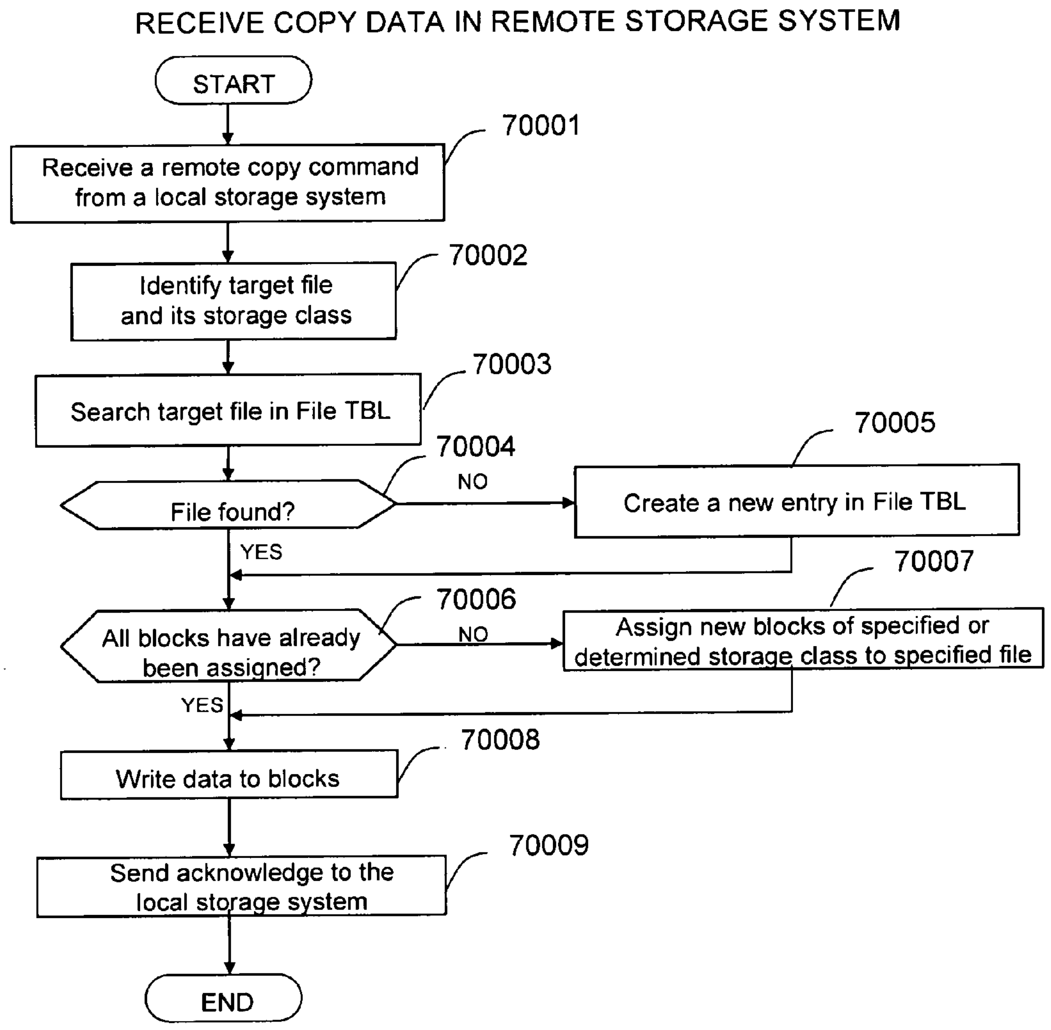

RECEIVE COPY DATA IN REMOTE STORAGE SYSTEM
START
Receive a remote copy command from a local storage system
70001
Identify target file and its storage class
70002
Search target file in File TBL
70003
File found?
70004
NO
Create a new entry in File TBL
70005
YES
All blocks have already been assigned?
70006
NO
Assign new blocks of specified or determined storage class to specified file
70007
YES
Write data to blocks
70008
Send acknowledge to the local storage system
70009
END

FIG. 7

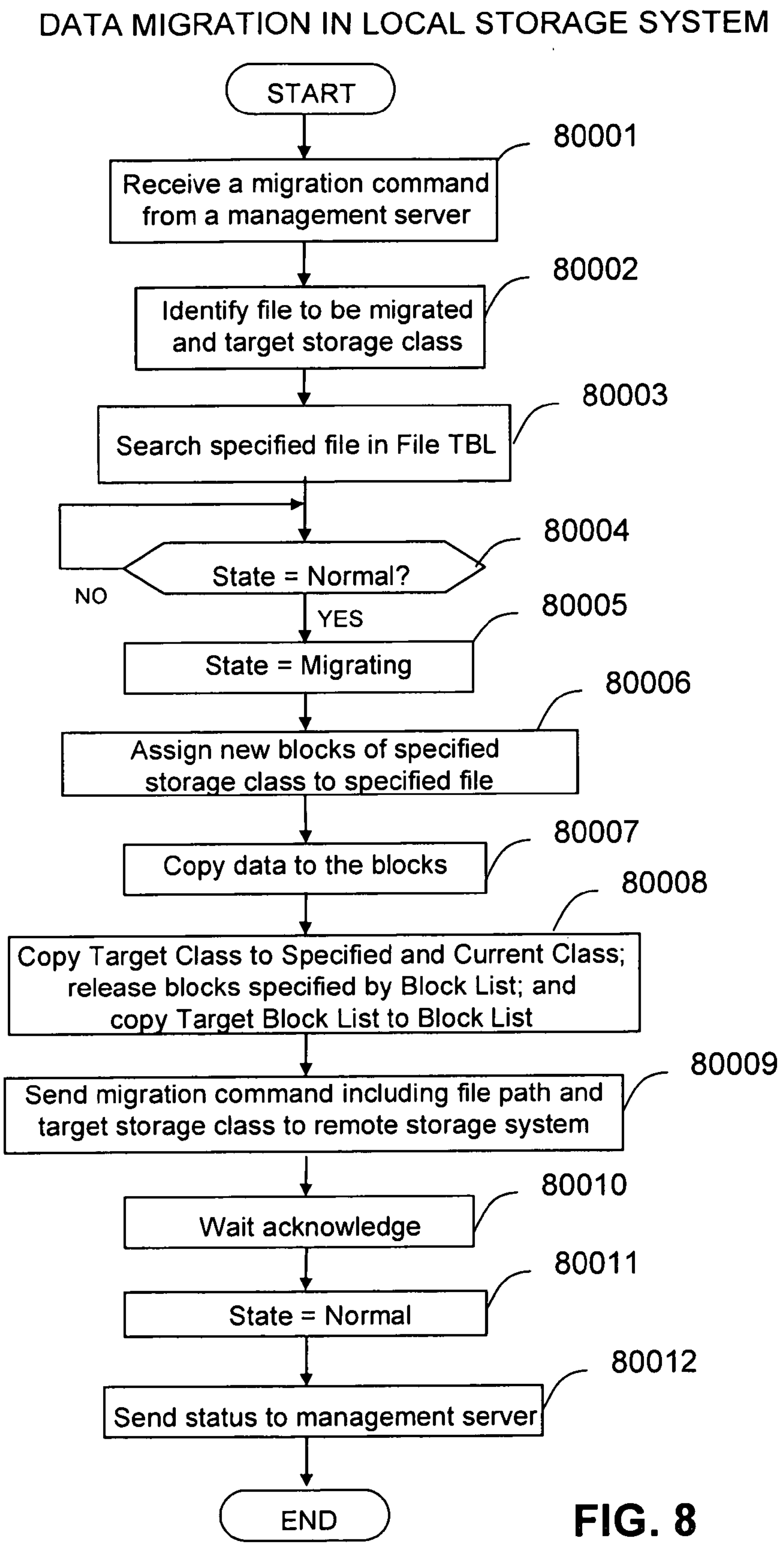

DATA MIGRATION IN LOCAL STORAGE SYSTEM
START
80001
Receive a migration command from a management server
80002
Identify file to be migrated and target storage class
80003
Search specified file in File TBL
80004
State = Normal?
NO
YES
80005
State = Migrating
80006
Assign new blocks of specified storage class to specified file
80007
Copy data to the blocks
80008
Copy Target Class to Specified and Current Class; release blocks specified by Block List; and copy Target Block List to Block List
80009
Send migration command including file path and target storage class to remote storage system
80010
Wait acknowledge
80011
State = Normal
80012
Send status to management server
END

FIG. 8

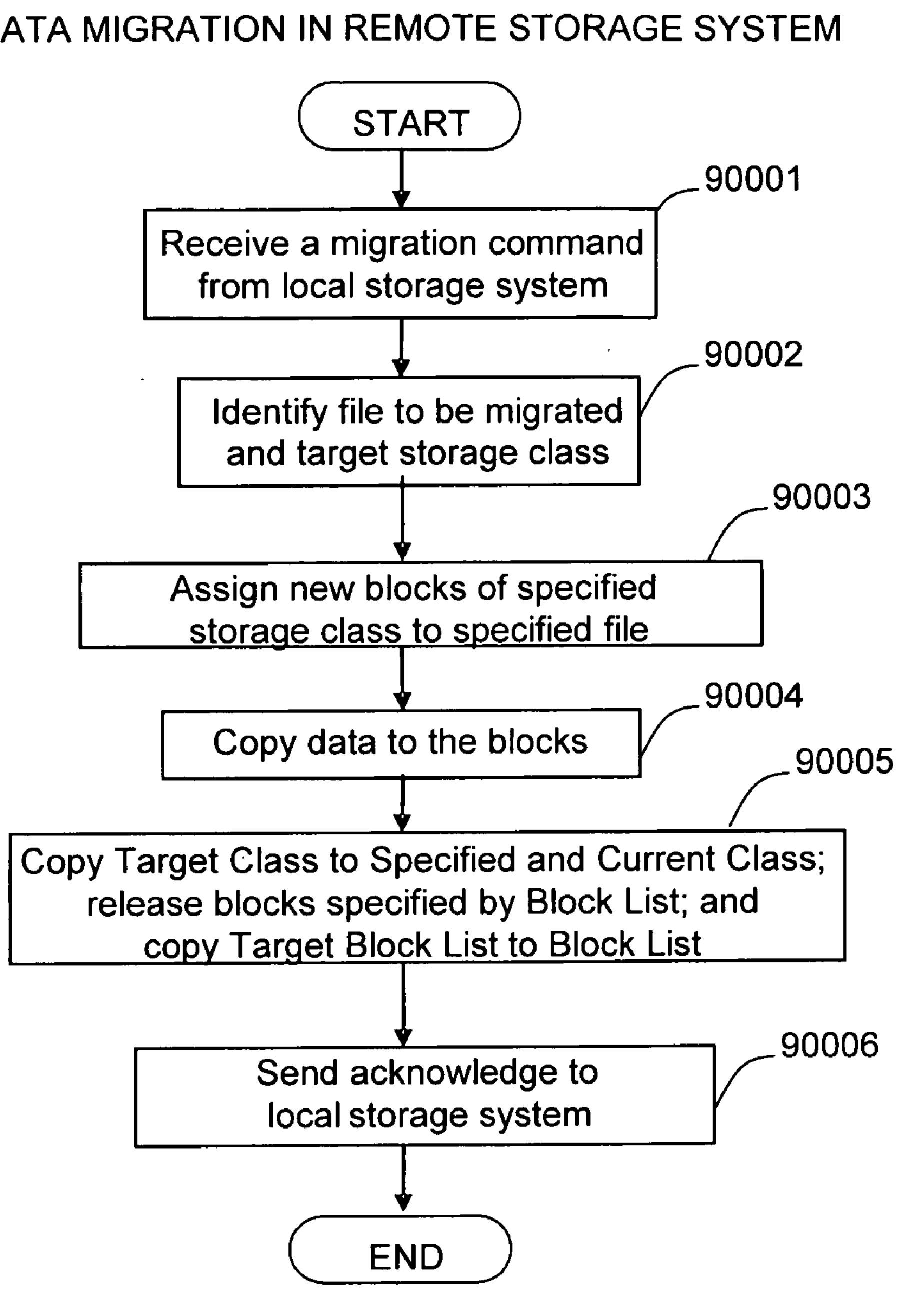
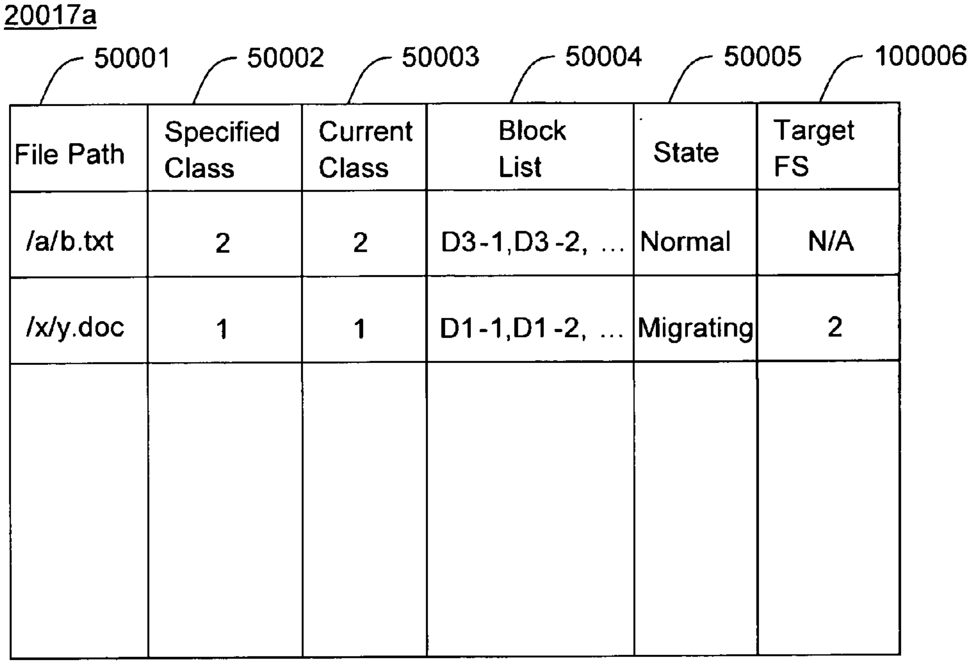

DATA MIGRATION IN REMOTE STORAGE SYSTEM
START
90001
Receive a migration command from local storage system
90002
Identify file to be migrated and target storage class
90003
Assign new blocks of specified storage class to specified file
90004
Copy data to the blocks
90005
Copy Target Class to Specified and Current Class; release blocks specified by Block List; and copy Target Block List to Block List
90006
Send acknowledge to local storage system
END

FIG. 9


20017a
50001
50002
50003
50004
50005
100006

File Path	Specified Class	Current Class	Block List	State	Target FS
/a/b.txt	2	2	D3-1,D3-2, ...	Normal	N/A
/x/y.doc	1	1	D1-1,D1-2, ...	Migrating	2

FIG. 10

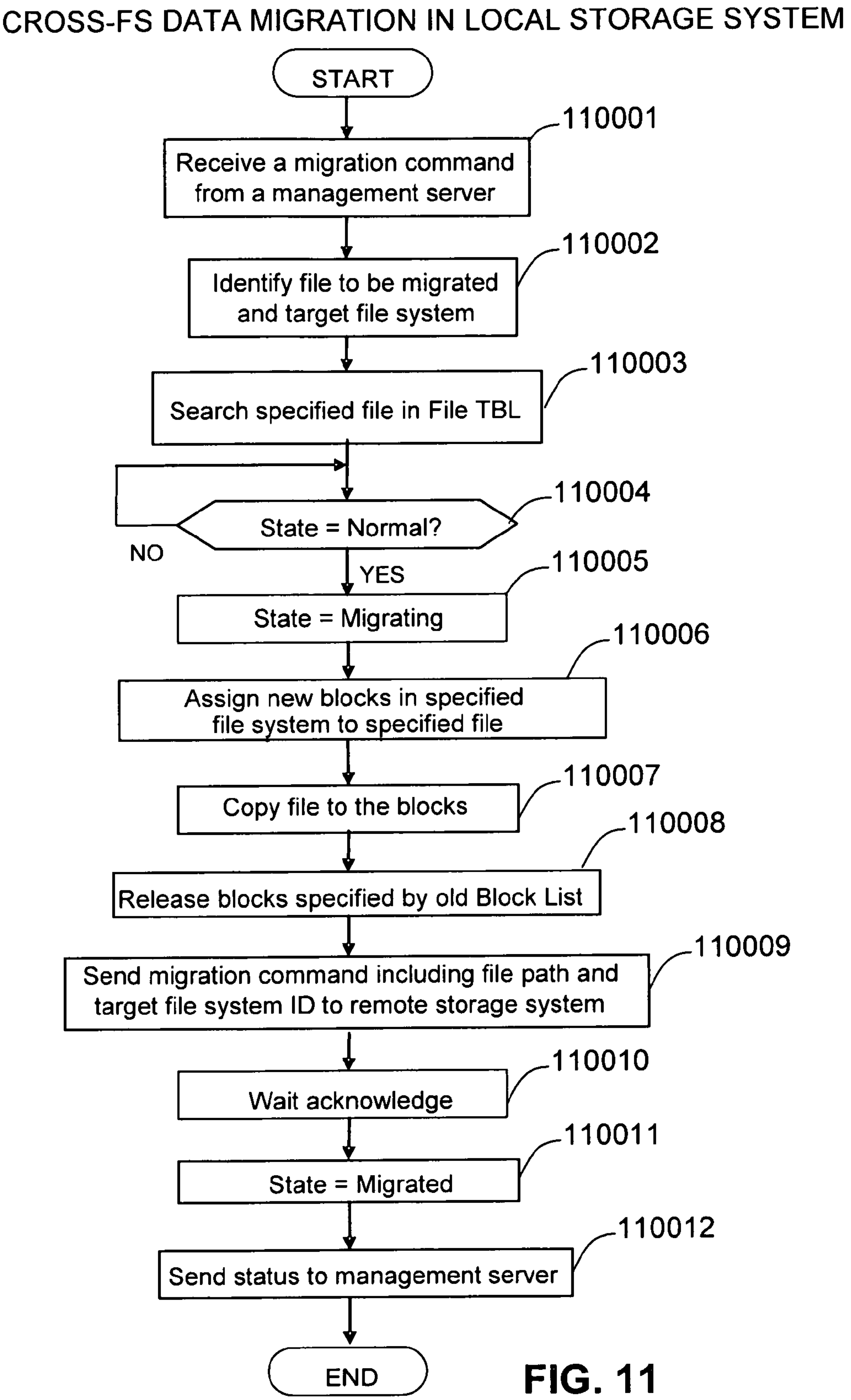

CROSS-FS DATA MIGRATION IN LOCAL STORAGE SYSTEM
START
110001
Receive a migration command from a management server
110002
Identify file to be migrated and target file system
110003
Search specified file in File TBL
110004
State = Normal?
NO
YES
110005
State = Migrating
110006
Assign new blocks in specified file system to specified file
110007
Copy file to the blocks
110008
Release blocks specified by old Block List
110009
Send migration command including file path and target file system ID to remote storage system
110010
Wait acknowledge
110011
State = Migrated
110012
Send status to management server
END

FIG. 11

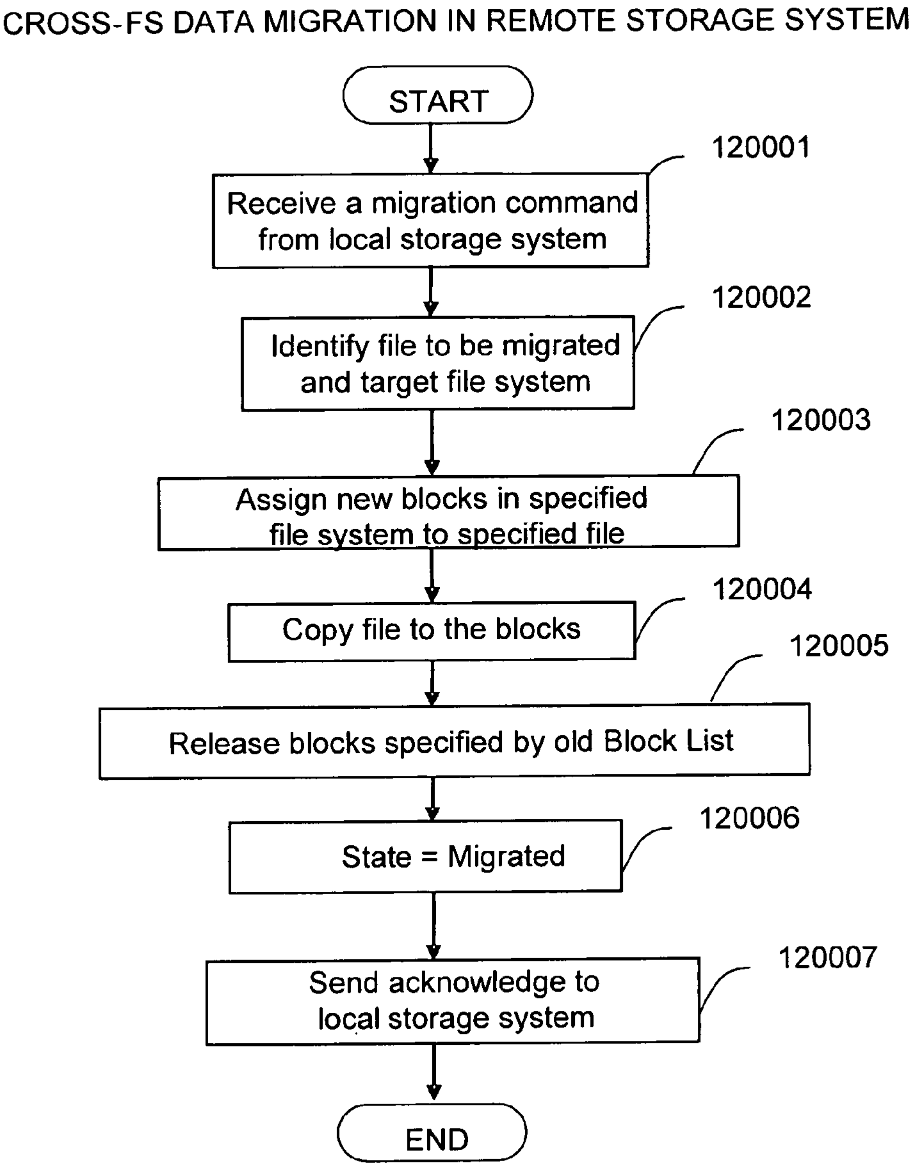

CROSS-FS DATA MIGRATION IN REMOTE STORAGE SYSTEM
START
Receive a migration command from local storage system
120001
Identify file to be migrated and target file system
120002
Assign new blocks in specified file system to specified file
120003
Copy file to the blocks
120004
Release blocks specified by old Block List
120005
State = Migrated
120006
Send acknowledge to local storage system
120007
END

FIG. 12

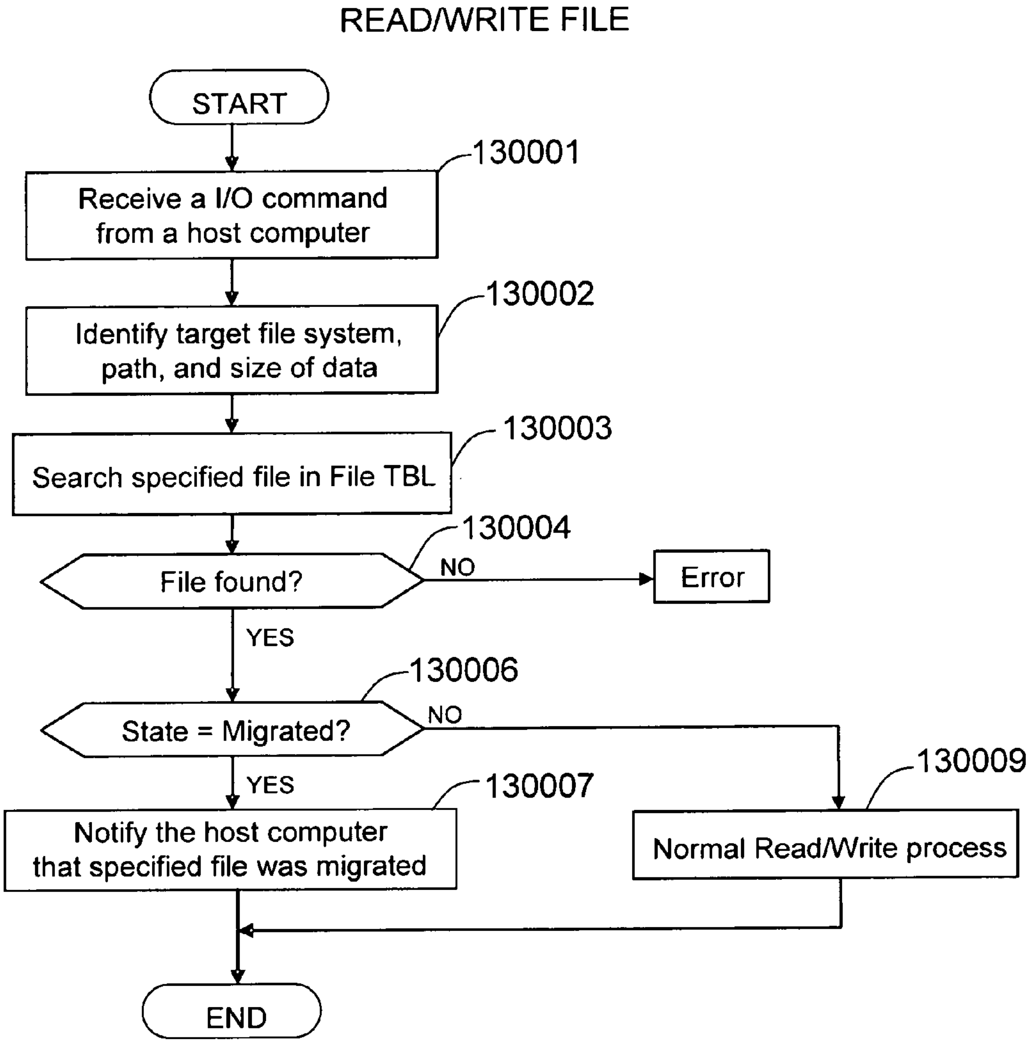

READ/WRITE FILE
START
130001
Receive a I/O command from a host computer
130002
Identify target file system, path, and size of data
130003
Search specified file in File TBL
130004
File found?
NO
Error
YES
130006
State = Migrated?
NO
YES
130007
Notify the host computer that specified file was migrated
130009
Normal Read/Write process
END

FIG. 13

REMOTE MIRRORING METHOD BETWEEN TIERED STORAGE SYSTEMS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a system and method for managing a storage system. In particular, the present invention relates to a system and method for managing the location of files copied between tiered storage systems.

[0003] 2. Description of Related Art

[0004] U.S. Patent Publication No. 2004/0193760 to Matsunami et al. discloses a storage device which migrates data among storage classes which form a storage hierarchy in the storage device. The entire disclosure of this publication is hereby incorporated by reference. According to the storage system disclosed in this publication, files are deployed in a storage hierarchy defining different storage classes in a manner so that the storage system can provide appropriate performance, reliability and other properties for each file.

[0005] However, if a local storage system copies its files to a remote storage system, such as in a remote mirroring arrangement, the storage class of the copied files in the storage hierarchy of the remote storage system may not always be the same as that in the local storage system. Thus, if there is a failure at the local storage system, and the remote storage system takes over operation for the local storage system, files will not necessarily be provided with the same hierarchy. This can cause degraded performance, reliability, and other problems since the remote storage system cannot provide desired properties and performance for each file.

BRIEF SUMMARY OF THE INVENTION

[0006] According to one aspect of the present invention, a method and system are provided in which files copied in a remote storage system are copied in such a manner that they reflect the arrangement of those files in a local storage system. This allows the remote storage system to provide the desired properties for the files in the same manner as the local storage system.

[0007] Further, each storage system may maintain information about the storage class of each file. When a file is written to a local storage system, and is copied to a remote storage system, information about the storage classification of the copied file is also sent. The remote storage system can then deploy the file in a storage hierarchy based on the information so as to deploy files in a manner similar to the local storage system.

[0008] Additionally, if the storage class of a file in a local storage system is modified, such as when a file is migrated from one storage area of one storage class to another storage area of another storage class, the local storage system sends a command to the remote storage system so that a copy of the migrated file in the remote storage system may also be migrated to a corresponding storage class in the remote storage system.

[0009] These and other objects, features and advantages of the present invention will become more apparent in view of the detailed description of the preferred embodiments in conjunction with the drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0010] FIG. **1** illustrates an overview of a computer storage system in which the method and apparatus of the present invention are applied.

[0011] FIG. **2** illustrates the local storage system or remote storage system in more detail.

[0012] FIG. **3** illustrates an example of a block table according to the present invention.

[0013] FIG. **4** illustrates an example of a file system table according to the present invention.

[0014] FIG. **5** illustrates an example of a file table according to the present invention.

[0015] FIG. **6** is a flowchart illustrating the process performed by the storage control program for writing a file in the local storage system.

[0016] FIG. **7** is a flowchart illustrating how copied data is received in the remote storage system.

[0017] FIG. **8** is a flowchart illustrating a process of data migration in the local storage system.

[0018] FIG. **9** is a flowchart illustrating a process of data migration in the remote storage system.

[0019] FIG. **10** illustrates a modified format of a file table.

[0020] FIG. **11** is a flow chart illustrating the process flow of the storage control program in the local storage system according to the second embodiment.

[0021] FIG. **12** is a flowchart illustrating the process flow of the storage control program in the remote storage system according to the second embodiment.

[0022] FIG. **13** is a flowchart illustrating how the storage control program handles a request to access a "migrated" file.

DETAILED DESCRIPTION OF THE INVENTION

FIRST EMBODIMENT

[0023] FIG. **1** illustrates an overview of a computer storage system in which the method and apparatus of the present invention are applied. In FIG. **1**, host computers **10000**, **10001** are connected to a local storage system **10008** via a LAN switch **10009** and LAN cables **10002**. Host computers **10000** and **10001** read and write data from the local storage system **10008** through the LAN switch **10009**. An administrator or storage management program of a management server **10006** controls the local storage system **10008**. The management server **10006** has a management interface **10007** to allow an administrator to communicate with the local storage system **10008**.

[0024] FIG. **1** also shows a remote storage system **10108** connected to host computers **10100** and **10101** via a LAN switch **10109** and LAN cables **10102**. A management server **10106** has a management interface **10107**, which both function in a manner similar to the management server **10006** and management interface **10007**, but are connected to the remote storage system **10108**. The local storage system **10008** and the remote storage system **10108** are coupled by a network **10010**. The local storage system **10008** copies its files to the remote storage system **10108** in order to provide redundancy if there is any failure at the local storage system **10008**. Further, an IP network **10011** allows host computers to connect with one another so that the remote host computers **10100** and **10101** can take over for local host computers **10000** and **10001**, if needed.

[**0025**] FIG. **2** illustrates more details of the local storage system **10008** and remote storage system **10108**. Each storage system **10008**, **10108** includes a LAN port **20001** for communication with management interface **10007**, **10107**, respectively, LAN ports **20002**, **20003** for communication with the hosts **10000-10101**, and LAN port **20004** for remote copy functions. A CPU **20011**, a cache memory **20012**, and a management memory **20013** may also be included in storage systems **10008**, **10108**, as is known in the art. Data from the host computers or the disk drives is stored temporarily in cache memory **20012** to shorten response time and increase throughput during I/O operations.

[**0026**] As shown in FIG. **2**, CPU **20011** executes a storage control program **20014** stored in management memory **20013**. The storage control program **20014** processes input/output (I/O) requests sent from host computers **10000-10101**, manages the deployment of files, and communicates with management consoles **10006**, **10106** of FIG. **1**. A fibre channel (FC) disk controller **20005** controls I/O from/to FC disk drives **20007**. FC disk drives are generally more expensive and can provide high-performance to host computers. On the other hand, low cost Serial Advanced Technology Attachment (SATA) disk drives such as SATA disk drives **20009** are also employed in storage systems **10008**, **10108**, and are connected to a SATA disk controller **20006**. SATA disk drives can provide larger capacity at a much lower cost when compared with FC disk drives. However, SATA disk drives generally provide lower performance and reliability than FC disk drives. According to this embodiment, each type of disk drives (i.e., FC or SATA) corresponds to a different storage class.

[**0027**] Management memory **20013** also may contain three tables that are used by the storage control program **20014** to manage files. These three tables are the block table **20015**, the file system table **20016** and the file table **20017**. Further, while storage control program **20014** and tables **20015-20017** are preferably stored in memory **20013**, they may also be stored and accessed in other computer readable mediums.

[**0028**] The block table **20015** is shown in more detail in FIG. **3**. This table contains all the information about all disk blocks in a storage system, and is used for managing which blocks are used for which file system. Each line contains a storage class **30001**, ID of the file system (FS ID) **30002**, a list of block IDs of all blocks **30003**, having the disk number and logical block number of all blocks in the file system, and a list of block IDs of free blocks **30004** which are blocks that are assigned but not used to store files. In the example of the figure, storage class **1** is shown to have file system IDs **1** and **2** and disks D**1** and D**2**, while storage class **2** is shown to have a file system ID **1** and disks D**3**.

[**0029**] FIG. **4** illustrates the file system table **20016** which contains information about all of the file systems in the storage system. This table includes a file system ID **40001**, the IP address of the LAN port **40002** from which the file system is exported, the path **40003** with which the file system is exported, the IP address of the remote copy port **40004** of the remote storage system, and the remote file system ID **40005** of a file system in the remote storage system to which files are copied from the local file system. This table shows information regarding file level copying.

[**0030**] FIG. **5** illustrates the file table **20017** which contains information about all files in the storage system. This table includes a file path **50001**, the specified storage class **50002** to store the file, the current storage class **50003** in which the file resides, the block list **50004** which is a list of blocks used to store the file, the state **50005** of the file, the target class **50006** which is the target storage class to migrate the file, and the target block list **50007** which is a list of blocks which will be used to store the migrated file. Thus, during a state of migrating, the target class **50006** indicates the class to which a file is being migrated. A file table **20017** is provided for each file system.

[**0031**] FIG. **6** is a flowchart showing the process performed by the storage control program **20014** for writing a file in the local storage system. Upon receiving a write command from a host computer at step **60001**, a target file system is identified which contains a file to be written, along with the path of the file and the size of the data to be written, which are retrieved from the command at step **60002**. Next, a file table **20017** of the target file system is searched in order to find the target file (step **60003**). If the file is not found (step **60004**), it does not exist and is a new file. In this case, at step **60005**, the storage class of the new file is determined and a new entry is created in the file table **20017**. This storage class can also be determined based upon predefined policy. For example, the policy could be to store every new file in storage class **1**. The storage control program **20014** creates a new entry in the file table **20017** and stores the path identified in step **60002** in column **50001** of file table **20017**. The determined storage class is stored in column **50002** and "normal" is stored in column **50005** of file table **20017**. "N/A" is stored in columns **50006-50007**.

[**0032**] Next, in the case that a file is found at step **60004** or if a new entry is created at step **60005**, it is determined in step **60006** whether the state of the file is "normal". This is because if the state of the file is "migrating" it cannot be accessed simultaneously. If the state is "normal", the state is changed to "writing" at step **60007**. If the file does not have enough blocks to store all of the data sent from the host computer (at step **60008**), the storage control program assigns new blocks from the specified storage class in the file system by referring to the block table **20015**, and stores the specified storage class into column **50003** of file table **20017** at step **60009**. If the specified storage class does not have enough blocks, new blocks are assigned from another storage class and that class is stored in column **50003**. The IDs of all the assigned blocks are removed from column **30004** of block table **20015** and added to column **50004** of file table **20017**. Then, data is written to the blocks at step **60010**. In the case where there was an insufficient number of blocks in the specified storage class, the entire file, including the new data is migrated to the alternate storage class.

[**0033**] In step **60011**, the storage control program **20014** sends a remote copy command including file path, data to be written, and storage class to a remote storage system, specifying the IP address of the remote port and ID of the remote file system stored in columns **40004** and **40005**, respectively, of file system table **20016**. The storage class is sent by the local storage system and used by the remote storage system so that the copied file is arranged in the remote storage system in a manner similar to the local storage system. Upon receiving an acknowledgement from the remote storage system at step **60012**, the state of the file is changed to "normal" at step **60015**, the status is sent to the host computer in step **60014**, and the process ends.

[**0034**] FIG. **7** illustrates how copy data is received in the remote storage system. The storage control program **20014** in the remote storage system **10108** receives a remote copy command from the local storage system at step **70001**. Then, the storage control program **20014** retrieves the target file and the storage class of the target file from the command at step **70002**. Steps **70003-70005** are similar to steps **60003-60005** described above in FIG. **6**, and thus do not need to be re-described. Additionally, steps **70006-70008** are similar to steps **60008-60010** in FIG. **6**, and also do not need to be described again here. At step **70009**, the storage control program **20014** sends back an acknowledgment to the local storage system. Based on the storage class sent from the local storage system, the copied file is arranged appropriately in the remote storage system.

[**0035**] FIG. **8** illustrates a process of data migration in the local storage system. At step **80001**, the migration command is received from a management server, which identifies the file system, the file to be migrated, the path of the file and the destination storage class. Further, while a management server is identified in this embodiment as sending the migration command, it should be understood that these commands and other commands may also be received from host computers or other authorized computers in communication with the local storage system. In step **80002**, the file system path and storage class are retrieved from the command. At step **80003**, the specified file is searched for in the file table **20017** of the specified file system and it is ensured that the state of the file is "normal" (step **80004**). If the state is "normal", the storage control program changes the state to "migrating" (step **80005**), and assigns new blocks of the specified storage class by looking up column **30004** (step **80006**) of block table **20015**. If the state is not "normal", this usually indicates that the file is currently being migrated or updated, and the process waits until this is completed. The IDs of the assigned blocks are removed from column **30004** and added to column **50007** of file table **20017**. The specified storage class is also stored in column **50006** of file table **20017**.

[**0036**] At step **80007**, data is copied to the blocks and then column **50006** of file table **20017** is copied to columns **50002** and **50003**. Blocks specified by column **50004** are released, namely, IDs stored in column **50004** of file table **20017** are removed and added to column **30004** of block table **20015**. Data in column **50007** of file table **20017** is copied to column **50004** and "N/A" is stored at columns **50006** and **50007** of file table **20017** (step **80008**). Next, a migration command including the file path and target storage class is sent to the remote storage system, specifying the IP address of the remote port and ID of the remote file system stored in columns **40004** and **40005**, respectively, at step **80009**. The storage class is sent by the local storage system and is used by the remote storage system so that the copied file is deployed in the remote storage system in a similar manner as the local storage system. The remote storage system carries out the process set forth in FIG. **9**, described below, and sends back an acknowledgement. Upon receiving acknowledgment from the remote storage system at step **80010**, the state of the file is changed to "normal" (step **80011**) and a status of the operation is sent to the management server at step **80012**.

[**0037**] FIG. **9** illustrates the data migration in the remote storage system. When the storage control program **20014** in the remote storage system **10108** receives a migration command (step **90001**), it retrieves the file path in specified file system and target storage class to which the file should be migrated at step **90002**. Steps **90003-90005** are similar to steps **80006-80008** in FIG. **8**, and do not need to be described again. Finally, the storage control program sends back an acknowledgement to the local storage system at step **90006**. Based on the storage class sent from the local storage system, the copied file can be arranged appropriately in the remote storage system so that the various properties and performance of the file can be provided by the remote storage system just as they would have been provided in the local storage system in the event there is a failure at the local storage system.

SECOND EMBODIMENT

[**0038**] According to the second embodiment of the present invention, one file system only contains one storage class. Therefore, if a file is migrated from one storage class to another, it is moved to another file system. FIG. **10** shows a modified format of the file table for use with the second embodiment as file table **20017***a*. Columns **50006** and **50007** are replaced by column **100006** which contains IDs of the target file system of migration, while columns **50001-50005** remain as described above with reference to FIG. **5**.

[**0039**] The process flow of the storage control program **20014** in the local storage system **10008** for the second embodiment is shown in FIG. **11**. The process in FIG. **11** shows the migration of a file between two file systems. The differences between this figure and FIG. **8** are now described. At step **110001** a migration command is received from the management server including the target file system instead of the target storage class. At step **110002** the file to be migrated is identified, as is the target file system. The specified file is searched for in the file table **20017***a* at step **110003** and it is determined whether the state of the file is "normal" (step **110004**) or "migrating" (step **110005**). If the state is not "normal", the process waits until the state becomes "normal", e.g., until a host I/O command or a prior migration command is completed. In step **110006**, a new entry is made in the file table **20017***a* of the target file system and new blocks are assigned in the target file system. At step **110007** the file is copied to the new blocks and at step **110008** blocks specified by an old block list are released. At step **110009** the target file system ID is sent to the remote storage system **10108** as opposed to the remote target storage class. The ID of the remote file system can be determined by looking at column **40005** of file system table **20016** in FIG. **4**. The remote storage system **10108** then carries out the steps of FIG. **12** described below and sends acknowledgement back to the local storage system **10008**. At step **110010**, a wait for acknowledgement is performed and, when acknowledgement is received, at step **110011** the state of the file is changed to "migrated" since the file no longer exists in the original file system anymore. Finally, at step **110012**, this status is sent to the management server.

[**0040**] FIG. **12** illustrates the process flow of the storage control program in the remote storage system according to the second embodiment. At step **120001**, a migration command is received by the remote storage system **10108** from the local storage system **10008**. At step **120002**, the ID of the target file system is retrieved instead of the target storage class. Steps **120003** and **120006** are similar to steps **110006** and **110011**, respectively, in FIG. **11**. At step **120004** the file is copied to the blocks and the blocks specified by the old block list are released at step **120005**. Finally, at step **120007**, an acknowledgement is sent to the local storage system.

[**0041**] FIG. **13** illustrates how the storage control program **20014** handles a request to access a "migrated" file. If the state of the specified file is "migrated" it notifies the host computer that the specified file was migrated. As shown in FIG. **13**, at step **130001** an I/O command is received from a host computer, and a target file system and path of the file are identified at step **130002**. At step **130003**, the specified file is searched in the file table **20017** or **20017***a*. If it is found at step **130004**, it is determined if its state is migrated (step **130006**). If so, the host computer is notified that the file was migrated at step **130007**. This may be achieved, for example, using the Network File System (NFS) version 4 migration feature, defined in RFC3530, wherein if a host computer requests a fs_locations attribute, the storage control program can return it by looking up the ID of the target file system (column **100006**), searching the ID in column **40001**, and returning columns **40002** and **40003** of file system table **20016**. If the state of the file is not migrated, then a normal read/write process is performed at step **130009**. On the other hand, if a file is not found at step **130004**, an error is issued.

[**0042**] While specific embodiments have been illustrated and described in this specification, those of ordinary skill in the art appreciate that any arrangement that is calculated to achieve the same purpose may be substituted for the specific embodiments disclosed. This disclosure is intended to cover any and all adaptations or variations of the present invention, and it is to be understood that the above description has been made in an illustrative fashion, and not a restrictive one. Accordingly, the scope of the invention should properly be determined with reference to the appended claims, along with the full range of equivalents to which such claims are entitled.

1. A method of reflecting a hierarchical storage class of a file that is copied from a first storage system to a second storage system comprising the steps of:

copying a file from the first storage system to the second storage system; and

sending class information regarding the file from the first storage system to the second storage system so that the second storage system can store a copy of the file in a hierarchical manner corresponding to how the file is stored in the first storage system.

2. The method according to claim 1, further including the steps of:

migrating the file from one storage area of one class to another storage area of another class in the first storage system; and

sending information regarding this change in class to the second storage system.

3. The method according to claim 2, further including the steps of:

receiving by the second storage system information regarding the change in class of the file; and

migrating, by the second storage system, the copy of the file from one storage area of one class to another storage area of another class in the second storage system, so that the copy of the file is stored in a storage area of a same class in the second storage system as the class in which the file is stored in the first storage system.

4. The method of claim 1 further including the steps of:

providing fibre channel storage devices as storage devices of a first class; and

providing Serial Advanced Technology Attachment (SATA) storage devices as storage devices of a second class.

5. The method of claim 3 further including the steps of:

providing fibre channel storage devices as storage devices of a first class; and

providing Serial Advanced Technology Attachment (SATA) storage devices as storage devices of a second class.

6. The method of claim 1, further including the steps of:

providing each of the first and second storage systems with first storage devices of a first storage class and second storage devices of a second storage class;

receiving a write command from a host computer by the first storage system;

identifying, by the first storage system, a file corresponding to the write command and a storage class for the file;

writing data to the storage devices of the identified storage class.

7. The method of claim 6, further including the steps of:

prior to writing the data to the storage devices of the identified storage class, determining whether the file has sufficient free blocks to store all data sent from the host computer; and

if a determination is made that the file does not have enough free block to store all the data, assigning new blocks from the identified storage class.

8. The method of claim 7, further including the steps of:

if there are insufficient free blocks in the identified storage class, assigning new blocks for the file in a different storage class; and

writing the data to the storage devices of the different storage class instead of to the identified storage class.

9. In a system having a first storage system and a second storage system, each said storage system including first storage devices of a first storage class and second storage devices of a second storage class, a method of accurately reflecting data stored in the first storage system at the second storage system such that when there is a failure at the first storage system, the second storage system can provide properties for files in a manner similar to that provided by the first storage system, the method comprising the steps of:

storing first data in the first storage system in the first storage devices of the first class; and

copying the first data to the first storage devices of the first class in the second storage system as second data.

10. The method according to claim 9, further including the step:

when the first data is migrated from the first storage devices of the first class to the second storage devices of the second class in the first storage system, the second storage system is notified of this migration.

11. The method according to claim 10, further including the step:

when the second storage system is notified of this migration, the second storage system migrates the second data from the first storage devices of the first class to the second storage devices of the second class in the second storage system.

12. The method according to claim 9, further including the steps of:

providing fibre channel disk drives as the first storage devices; and

providing Serial Advanced Technology Attachment (SATA) disk drives as the second storage devices, or vice versa.

13. The method according to claim 11, further including the steps of:

providing fibre channel disk drives as the first storage devices; and

providing Serial Advanced Technology Attachment (SATA) disk drives as the second storage devices, or vice versa.

14. The method according to claim 9, further including the steps of:

providing a first file system and a second file system in each of said first and second storage systems, wherein the first file system is stored in said first storage devices of said first class and said second file system is stored in said second storage devices of said second class.

15. The method according to claim 14, further including the steps of:

migrating said first data from the first storage devices of the first class to the second storage devices of the second class in the first storage system, such that the first data is moved from the first file system to the second file system, and the second storage system is notified of this migration.

16. The method according to claim 15, further including the steps of:

migrating by said second storage system said second data from the first storage devices of the first class to the second storage devices of the second class in the second storage system, such that the second data is moved from the first file system to the second file system in the second storage system.

17. A storage system comprising:

a local storage system storing a plurality of first files of a first storage class and a plurality of second files of a second storage class; and

a remote storage system coupled to the local storage system and storing copies of the plurality of first files and second files,

wherein the copies of the plurality of first files and second files are stored in the remote storage system in the same storage class in which they are stored in the local storage system.

18. The storage system according to claim 17, wherein the local storage system has a management memory storing a table indicating the storage class of each file.

19. The storage system according to claim 17, wherein after a file is written in the local storage system, a remote copy command including the storage class of the file is sent to the remote storage system.

20. The storage system according to claim 17:

wherein the local storage system and the remote storage system, each includes first disk devices of a first storage class and second disk devices of a second storage class, different from that of the first storage class;

wherein, upon receiving a first migration command, the local storage system migrates a file from a first location in one or more of said first disk devices of the first storage class to a second location in one or more of said second disk devices of said second storage class;

wherein the local storage system sends a second migration command to the remote storage system, said second migration command including a target storage class; and

the remote storage system migrates a file identified by the second migration command to a target storage class identified by the second migration command.

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